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REPORT OF PROGRESS IN SPECTRUM WORK.

By PROFESSOR HENRY A. ROWLAND.

During the past year or two a great deal of work has been done in the photography of the spectra of elements and the identification of the lines in the solar spectrum, which it will take a long time to work up, ready for publication. Hence, I have thought that a short account of what has been done up to the present time might be of interest to workers in the subject. In the prosecution of the work financial assistance has been received from the Rumford Fund of the American Academy of Arts and Sciences, as well as from the fund given by Miss Bruce to the Harvard Astronomical Observatory for the promotion of research in astronomical physics, and the advanced state of the work is due to such assistance.

The work may be summed up under the following heads:

1st. The spectra of all known elements, with the exception of a few gaseous ones, or those too rare to be yet obtained, have been photographed in connection with the solar spectrum, from the extreme ultra violet down to the D line, and eye observations have been made on many to the limit of the solar spectrum.

2d. A measuring engine has been constructed with a screw to fit the above photographs, which, being taken with the concave grating, are all normal spectra and to the same scale. This engine measures *wave lengths direct*, so that no multiplication is necessary, but only a slight correction to get figures correct to $\frac{1}{100}$ of a division of Angstrom.

3d. A table of standard wave lengths of the impurities in the carbons, extending to wave length 2000, has been constructed to measure wave lengths beyond the limits of the solar spectrum.

4th. Maps of the spectra of some of the elements have been drawn on a large scale ready for publication.

5th. The greater part of the lines in the map of the solar spectrum have been identified and the substance producing them noted.

6th. The following rough table of the solar elements has been constructed entirely according to my own observations, although, of course, most of them have been given by others.

I do not know which are the new ones but call attention to Silicon, Vanadium, Scandium, Yttrium, Zirconium, Glucinum, Germanium and Erbium, as being possibly new.

Silicon has lines on my map at wave lengths 3905.7, 4103.1, 5708.7, 5772.3 and 5948.7. That at 3905.7 is the largest and most certain. That at 4103.1 is also claimed by Manganese.

ELEMENTS IN THE SUN, ARRANGED ACCORDING TO THE INTENSITY AND THE NUMBER OF LINES IN THE SOLAR SPECTRUM.

According to Intensity.	*According to Number.*
Calcium.	Iron (2000. or more).
Iron.	Nickel.
Hydrogen.	Titanium.
Sodium.	Manganese.
Nickel.	Chromium.
Magnesium.	Cobalt.
Cobalt.	Carbon (200 or more).
Silicon.	Vanadium.
Aluminium.	Zirconium.
Titanium.	Cerium.
Chromium.	Calcium (75 or more).
Manganese.	Scandium.
Strontium.	Neodymium.
Vanadium.	Lanthanum.
Barium.	Yttrium.
Carbon.	Niobium.
Scandium.	Molybdenum.
Yttrium.	Palladium.
Zirconium.	Magnesium (20 or more).
Molybdenum.	Sodium (11).
Lanthanum.	Silicon.
Niobium.	Strontium.
Palladium.	Barium.
Neodymium.	Aluminium (4).
Copper.	Cadmium.
Zinc.	Rhodium.
Cadmium.	Erbium.
Cerium.	Zinc.
Glucinum.	Copper (2).
Germanium.	Silver (2).
Rhodium.	Glucinum (2).
Silver.	Germanium.
Tin.	Tin.
Lead.	Lead (1).
Erbium.	Potassium (1).
Potassium.	

Doubtful Elements.

Iridium.
Osmium.
Platinum.
Ruthenium.
Tantalum.
Thorium.
Tungsten.
Uranium.

Not in Solar Spectrum.

Antimony.
Arsenic.
Bismuth.
Boron.
Nitrogen (vacuum tube).
Caesium.
Gold.
Indium.
Mercury.
Phosphorus.
Rubidium.
Selenium.
Sulphur.
Thallium.
Praeseodymium.

Substances not yet Tried.

Bromine.
Chlorine.
Iodine.
Fluorine.
Oxygen.
Tellurium.
Gallium.
Holmium.
Thulium.
Terbium, etc.

These tables are to be accepted as preliminary only, especially the order in the first portion. However, being made with such a powerful instrument and with such care in the determination of impurities, they must still have a weight superior to most others published.

The substances under the head of "Not in the Solar Spectrum" are often placed there because the elements have few strong lines or none at all in the limit of the solar spectrum when the arc spectrum, which I have used, is employed. Thus boron has only two strong lines at 2497. Again, the lines of bismuth are all compound and so too diffuse to appear in the solar spectrum. Indeed, some good reason generally appears for their absence from the solar spectrum. Of course, this is little evidence of their absence from the sun itself.

Indeed, were the whole earth heated to the temperature of the sun, its spectrum would probably resemble that of the sun very closely.

With the high dispersion here used the "basic lines" of Lockyer are widely broken up and cease to exist. Indeed, it would be difficult to prove anything except accidental coincidences among the lines of the different elements. Accurate investigation generally reveals some slight difference of wave length or a common impurity.

Furthermore, the strength of the lines in the solar spectrum is generally very nearly the same as that in the electric arc, with only a few exceptions, as for instance calcium. The cases mentioned by Lockyer are generally those where he mistakes groups of lines for single lines or even mistakes the character of the line entirely. Altogether there seems to be very little evidence of the breaking up of the elements in the sun as far as my experiments go.

Even after comparing the solar spectrum with all known elements, there are still many important lines not accounted for. Some of these I have accounted for by silicon and there are probably many more. Of all known substances this is the most difficult to bring out the lines in the visible spectrum although it has a fine ultra-violet one. Possibly iron may account for many more, and all the elements at a higher temperature might develop more. Then, again, very rare elements like scandium, vanadium, etc., when they have a strong spectrum, may cause strong solar lines and thus we may look for new and even rare elements to account for very many more. Indeed, I find many lines accounted for by the rare elements in gadolinite, samarskite and fergusonite other than yttrium, erbium, scandium, praeseodymium, neodymium, lanthanum and cerium, which I cannot identify yet and which may be without a name. For this reason, and to discover rare elements, I intend finally to try unknown minerals as my process gives me an easy method of detecting any new substance or analyzing minerals however many elements they may contain.

The research is much indebted to the faithful and careful work of Mr. L. E. Jewell who has acted as my assistant for several years. Preliminary publications of results will be made in the *University Circulars*.

Among the latest results I may mention the spectroscopic separation of yttrium into three components, and the actual separation into two.

SPECIFIC INDUCTIVE CAPACITY OF ELECTROLYTES.[1] [ABSTRACT.]

By EDWARD B. ROSA.

I. The study of the specific inductive capacity of water and other conducting liquids was suggested to me about a year ago by Professor Rowland. Cohn and Arons and others had recently found values of K for water, ranging from 75 to 85 and for alcohol from 25 to 30; these exceeded so many times the value of K for most non-conductors that it seemed possible that there might be a relation between the conductivity and inductivity;[2] that these high values were directly due either to comparatively large conductivity or else both conductivity and inductive capacity were due to some common property of these liquids. In short, that the measured specific inductive capacities of conducting liquids were not genuine specific inductive capacities, the square roots of which, according to the electro-magnetic theory of light, should equal the corresponding indices of refraction, for waves of periods equal to those employed in measuring K. As will appear from the following pages, this anticipation has not been realized, the experiments indicating that these large values are true inductivities.

II. The method adopted for studying the question was to measure the force exerted between a fixed and a movable electrode in an electrolytic cell, varying the difference of potential of the electrodes, their distance apart, the periods of the alternating potentials employed, the temperature of the electrolyte, and its conductivity (the latter by varying the quantity of dissolved salts or other impurities). Water and alcohol are the electrolytes studied, and their behavior has been compared with that of air, turpentine and other dielectrics.

APPARATUS.

The apparatus containing the electrolytic cell is shown in Fig. 1. The movable electrode is suspended by a fine silver wire (.009 cm. in diameter) which conducts the current[3] to the electrode and whose torsion measures the force of attraction in question. The silver wire is attached above to the torsion head a, and below at the mirror c to a thick wire which passes down into the liquid (contained in the glass dish d); then, bending at right angles, it forms an arm about 4 cms. long, at the end of which is attached the movable electrode, hereafter called the needle. Several forms of needle were used, but in order to secure a quick, nearly dead-beat motion it was usually constructed of from two to five narrow plates above one another in horizontal planes, held together by vertical wires. The fixed electrode consists of a vertical plate of platinum, $3\frac{1}{2} \times 5$ cms. It is attached to a brass piece which slides in a slot in the ebonite plate e, and a graduated scale s permits the

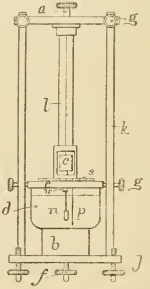

FIG. 1.

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[1] An abstract of this paper was read before the American Association for the Advancement of Science, Indianapolis, August, 1890.

[2] This seems to be a somewhat prevalent opinion. Thus, Andrew Gray (*Absolute Measurements in Electricity and Magnetism*, p. 491) says, referring to Cohn and Arons' determination of K for water and alcohol: "These substances have, however, considerable conductivity, which would tend, of course, to give an apparently high specific inductive capacity."

[3] The current traversing this wire in the experiments was not sufficient to change its temperature as much as the ordinary fluctuations in the temperature of the room.

plate to be set at any desired point. All parts dipping into the liquid are made of platinum. A scale at a distance of three metres is seen by reflection at the mirror *c* through a large reading telescope. By means of a long wooden lever, attached to the torsion head *a* and within reach of the observer at the telescope, the needle was always brought nearly to the same standard scale reading when the force was acting upon it. This insured a constant distance between the needle and plate, and the amount of the deflection was determined by taking the difference between this (nearly constant) deflected reading and the reading when the needle and plate are brought to the same potential. The distance (three metres) between the mirror and scale is sufficiently great so that the force may safely be taken as proportional to the scale readings.

III. With this apparatus, during the months of May, June, and July, a series of measurements of the force on the needle in different liquids was made, in which the following circumstances were varied in turn:

1. Difference of potentials between the electrodes.
2. Distance between the electrodes.
3. Rate of alternations of the current.
4. Conductivity of the liquids.
5. Temperature.

1. *Variation of Potential;—Turpentine, Water and Alcohol.*—In the following tables the numbers in the third column are proportional to the squares of the potentials given in the first column, and the quotients of the deflections by these squares (column 4) are constant within the limits of experimental errors. These nearly constant quotients are, however, slightly smaller in all cases for low potentials. This is doubtless due to the index error of 0.2 volt, which would be appreciable only in the case of the lower potentials.

Table I.—*Turpentine.*

Potentials, V.	Deflections.	Squares of $\frac{V}{10}$	Constant Quotients.
10 volts.	.10 cm.	1	.10
20	.41	4	.1025
30	.92	9	.1022
40	1.635	16	.1022
50	2.54	25	.1016
56.7	3.30	31.15	.1027

Table II.—*Water.*

Potentials, V.	Deflections.	Squares of $\frac{V}{5}$	Constant Quotients.
5 volts.	.35	1	.35
10	1.49	4	.37
15	3.51	9	.390
20	6.27	16	.392
25	9.93	25	.397
30	14.20	36	.394
35	19.15	49	.391
40	24.86	64	.389

Table III.—*Alcohol.*

Potentials, V.	Deflections.	Squares of $\frac{V}{5}$	Constant Quotients.
5	.11	1	.110
10	.48	4	.120
15	1.13	9	.125
20	2.03	16	.127
25	3.14	25	.126
30	4.45	36	.124
35	6.07	49	.124
40	7.91	64	.124
45	9.98	81	.123
50	12.39	100	.124
55	15.04	121	.124
60.75	18.45	147.6	.125

From these measurements it will appear that the force is accurately proportional to the square of the potential for these electrolytes as well as for dielectrics.

2. *Variation of Distance between Electrodes.*—In the following tables the readings of the deflections were made in the order of the preceding numbers.

Table V.—*Turpentine.*
[Constant potential of 50 volts.]

Distance between Electrodes.	Deflections.			
0.25 cms.		—	12	6.12
0.5	1	2.54 cms	11	2.55
1.0	2	1.05	10	1.06
1.5	3	.60	9	.61
2 0	4	.40	8	.39
2.5	5	27	7	.27
3.0	6	.21		—

Table VI.—*Alcohol.—Temp.* 22.5°.
[Constant potential of 40 volts.]

Distance between Electrodes.	Deflections.			
0.5 cms.	6	19.53 cms.		—
1.0	5	7.68	7	7.78
1.5	4	4.41	8	4.53
2.0	3	3.03	9	3.06
2.5	2	2.21	10	2 26
3.0	1	1.70	11	1.76

The plate cannot be set with anything like the accuracy with which the distance between needle and plate can be maintained constant, since the motion of the needle is magnified by the telescope and scale over a hundred times. Consequently the above measurements for variation of distance at constant potential are not as accurate as those previously given for variation of potential at constant distance.

If these measurements be plotted out with distances and deflections as abscissas and ordinates respectively, we get two curves resembling equilateral hyperbolas, and if the ordinates of the alcohol curve be shortened eight times the two curves will be almost indistinguishable. In other words, the rate of variation of the force with the distance between the electrodes is the same for turpentine as for alcohol (and water) and in general is probably the same for dielectrics and electrolytes.

3. *Variation of Rate of Alternation of Potentials.*—The effect of change of speed of the commutator is generally small and often inappreciable. With water the deflection is greater at higher speeds, although for quite pure distilled water the difference is extremely small. For less pure water it is larger, although not often more than 2 or 3 per cent., and is probably due to polarization at the slower speeds. Not the slightest trace of bubbles appears on the electrodes when using moderately pure water, but with ordinary hydrant water at rather high potentials bubbles appear at all speeds. The needle is less steady at very low speeds, and when the commutator stops the deflection changes considerably and is uncertain in amount except for very low potentials. It then depends also on the direction of the current. These phenomena were studied at some length, but as they seem to have no direct bearing on the present question, further reference to them is omitted.

4. *Variation of Conductivity.*—The resistance of different samples of distilled water is very different, and yet the difference noted in the force of attraction between the electrodes was relatively small. A single drop of a dilute solution of copper sulphate was added to a half litre of distilled water; the conductivity was increased about ten times while the force of attraction diminished about 15 per cent. Hydrant water, of comparatively large conductivity, showed a force 10 per cent. to 40 per cent. less than distilled, according to the potential, the effect of polarization being relatively greater at low potentials.

Thus, as far as the force of attraction depends upon the conductivity, it seems to be less as the conductivity is greater, and that because of polarization. Could the latter be eliminated in the case of these impure waters the force would probably be practicably independent of the conductivity. Polarization reduces the force of attraction, as it reduces the current, in two distinct ways. First, by the counter-electromotive force excited which diminishes the effective fall of potential, and, second, by increasing the resistance at the electrodes. This decreases the current by increasing the total resistance; but it decreases the force not at all because of an increase in the *total* resistance, but because the additional resistance is introduced at one or two places and not uniformly throughout the liquid. The result is that the fall of potential is less in the liquid near the needle than before, and therefore the force on the needle is less.

5. *Variation in Temperature.*—In order to determine the variation of the force with temperature the apparatus (Fig. 1) was set into a large glass jar which was then filled with water up to the ebonite cover *e*, or about a centimetre above the level of the liquid in the glass dish. The mirror remained in view above the top of the jar. Using hot water and ice as needed the temperature of the water bath was varied between 3° and 33° c., in a few cases being carried up to 45°. As soon, however, as the temperature rose much above that of the surrounding air, vapor condensed on the mirror

and window before it, and thus rendered observations difficult or impossible. In every case time was allowed for the temperature of the liquid (water or alcohol) to become nearly stationary before observations were made; otherwise convection currents made the needle unsteady. However, it was not possible to keep the temperature perfectly steady and the measurements, which are plotted out in Figs. 6 and 7, are not as accurate and consistent as though made at one temperature. In the case of alcohol the needle was very unsteady above about 26°, and several rough measurements (Nos. 3, 4 and 9) made at higher temperatures are omitted from the diagram; but none are omitted below 26°, although Nos. 5 and 6 were somewhat unsteady. Ordinates represent temperatures and abscissas represent the excess of deflections above 4.4 cms. in case of alcohol and 8.0 cms. in case of water. The observations were made in groups in the order of the numbers on the diagram and extended in the case of alcohol through a period of twelve hours. It will be noticed that the alcohol was carried several times through the given range of temperature; observations, Nos. 2, 10 and 16, fall closely together near 25°, but between Nos. 2 and 10 the alcohol was cooled to 7° and between Nos. 10 and 16 to 3° (see Fig. 6). The observations fall upon a straight line as nearly as could be expected from the circumstances of the case. They indicate a rather large temperature coefficient, the force falling off about 10 per cent. between 3° (5.20) and 26 (4.70). The conductivity, on the other hand, rapidly increases with the temperature, although no attempt was made to determine a value for its temperature coefficient. According to Foussereau, the conductivity of alcohol increases nearly 30 per cent. between 3° and 26°.

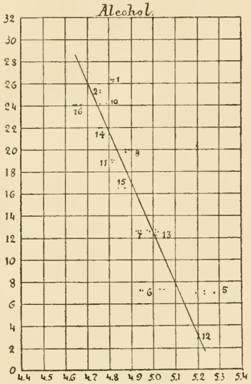

Fig. 6.

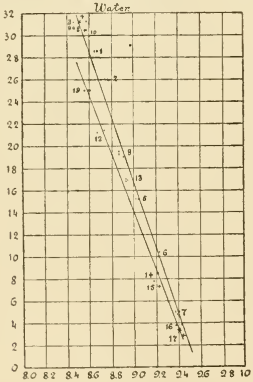

Fig. 7.

In the case of water the observations do not lie as clearly upon one straight line, but the later observations are nearer to a second straight line nearly parallel to the first. This is believed to be due to polarization effects which increased during the course of the day, the observations having extended over a period of 14 hours. However, the difference between the first and last measurements is scarcely more than one per cent., and the temperature coefficient obtained from either or both combined will differ but little. The force falls off about 10 per cent, between 3° and 31°, a somewhat smaller change than with alcohol.

Assuming the specific inductive capacity to be proportional to the force we have the following expressions for the temperature coefficients:

$$\text{For Alcohol } \frac{1}{K}\cdot\frac{dK}{dT} = -.0046 \text{ for } T = 20^\circ \text{ C.}$$

$$\text{For Water } \frac{1}{K}\cdot\frac{dK}{dT} = -.0038 \text{ for } T = 20^\circ \text{ C.}$$

VALUES OF K.

IV. The value of K for any liquid may be determined by taking the ratio of the force on the needle at a given distance from the fixed electrode for a given potential, the medium being the given liquid, to the force on the needle for the same distance and potential, the medium being air. The liquid chosen to compare with air was Diamond White Headlight Oil (a high grade of refined petroleum), and this was afterward used as a standard of comparison with other liquids.

In the following table the forces for the two liquids at 29.8 and 43.8 volts respectively are given.

TABLE X.

			Double Deflections.	
1	D. W. H. Oil 29.8 volts.		1.450 cms.	
2		Air, 43 8 volts.		1.482
3		do		1.473
4		do		1.472
5	do		1.438	
6		do		1.471
7	do		1.430	
8	do		1.436	
		Means.	1.438	1.474

Each of the numbers given in the columns of deflections is the mean of several separate measurements.

We have

$$\text{in air, } F = AkV^2$$

$$\text{and in oil, } F_1 = AK_1V_1^2$$

where F and F_1 are the forces in air and oil, respectively; V and V_1 the potentials, A is a constant, K_1 = specific inductive capacity of the oil and $k = 1$.

$\therefore K_1 = \frac{F_1}{F}\cdot\frac{V^2}{V_1^2} = \frac{1.438}{1.474}\cdot\left(\frac{43.8}{29.8}\right)^2 = \mathbf{2.11}$, at 24.0° C. the *specific inductive capacity of Diamond White Headlight Oil.*

WATER.

The means of three series of measurements of the force for 19.8 volts at 25.0° were 11.88, 11.80, 11.89. Mean = 11.86 = F. Mean for 44.8 volts in D. W. H. Oil = 1.69 = F_1.

$$K = K_1\cdot\frac{F}{F_1}\cdot\frac{V_1^2}{V^2} = 2.11 \times \frac{11.86}{1.69} \times \left(\frac{44.8}{19.8}\right)^2 = \mathbf{75.7} =$$

specific inductive capacity of water at 25° C.

The following is a list of several liquids with the corresponding values of K determined in this manner.

VALUES OF K FOR LIQUIDS.

Water at	25° C.,	75.7.
Alcohol	25°,	25.7.
Sperm oil	20°,	3.09.
Benzine	21°,	2.45.
Turpentine, commercial	18.6°,	2.43.
"Neutral" petroleum	21°,	2.26.
D. W. Headlight oil	24°,	2.11.

SUMMARY.

V. (*a*). The expression for the force between two electrodes having a homogeneous medium between them, thus forming a condenser, is of the form

$$F = AKV^2.$$

For a given liquid and given electrodes at a constant distance F is proportional to V^2. This is found to hold for electrolytes as well as dielectrics through the wide range of potentials employed.

(*b*). When the potentials and medium are constant and the distance between the electrodes varied the value of F in the above equation varies in a manner sensibly independent of the nature of the medium, depending only on the capacity of the condenser.

(*c*). When the speed of the commutator changes the force is but slightly altered, unless the electrolyte is a fairly good conductor. In the latter case the force is diminished as the speed is reduced, owing to polarization. There is a small change in the force with turpentine due to variation of speed, although none in the case of air. With turpentine as with pure water and alcohol the change is very small, the force being greater in every case with higher speeds.

(*d*). When the conductivity of distilled water is increased by adding hydrant water or minute quantities of acid or copper-sulphate the force is not greatly altered although the current increases many times. The force, however, decreases, which is believed to be due to polarization. Were the latter wholly eliminated the force would probably remain unaltered; at most it could differ but little.

(*e*). When the temperature rises, other circumstances remaining unaltered, the conductivity increases while the force decreases, the rate being constant or nearly so within the range of experiment. This decrease in the force, however, cannot be accounted for by polarization, for the increase of conductivity is not sufficient to make an appreciable difference in polarization effects. This is further proved by the fact that the force is immediately increased by a small decrease in the temperature, the curve returning upon itself, while if it were a case of polarization the curve would more resemble the hysteresis curve of magnetization.

VI. The only other determinations of temperature coefficients which I have seen are those of W. Cassie,[1] made at the Cavendish Laboratory. He worked with a number of solid and liquid dielectrics, for the most part between about 15° and 50° or 60° C. Here are his mean values of $\frac{1}{K}\frac{dK}{dT}$.

Solids.		*Liquids.*	
Mica	+ .0003	Turpentine	— .0011
Ebonite	+ .0004	Carbon-bisulphide	— .0040
Glass	+ .0012	Glycerine	— .0056
do.	+ .0020	Benzoline	— .0011
		Benzine	— .0013
		Olive Oil	— .0024
		Paraffine Oil	+ .0023

We notice that the solids and paraffine oil have positive coefficients, while all the other liquids have negative coefficients, like water and alcohol. Further, the values of the temperature coefficients for water and alcohol are not only of the same order of magnitude as those for the given liquid dielectrics, but both (—.0038 and —.0046) fall within the limits of the series, water having a value less than carbon-bisulphide and glycerine and greater than turpentine, benzoline, benzine, and olive oil.

VII. It is very convenient to think of the force acting on the needle as due to a given charge tending to flow down a given slope of potential. Letting $\frac{dV}{dx}$ represent the resultant slope of potential, the displacement over the surface of the needle is $A_1K\frac{dV}{dx}$, A_1 being a constant depending on the needle, and K a constant depending on the medium. One can just as readily imagine this displacement occurring in a conducting as in a non-conducting medium. Indeed Maxwell says[1] that this inductive capacity probably exists in all bodies. The capacity of a condenser consisting of two electrodes immersed in a conducting medium cannot be measured by discharging its accumulated charge through a galvanometer, and noting the deflection of a magnetic needle. But it is as directly measured by noting the force which this constant (but continually renewed) charge exerts as it tends to flow down a given slope of potential. The conductivity of water depends mainly if not wholly upon its impurities, which form in the case of distilled water an indefinitely small part of its bulk. The inductivity, on the other hand, is a property of the water itself and hence ought not to be appreciably modified by small quantities of foreign substances, though it might be greatly different if they constituted a large part of its bulk. We may thus think of conduction and induction producing their separate effects side by side, the former not affecting the latter. Conduction may, however, affect the force $A_1K\left(\frac{dV}{dx}\right)^2$ by modifying $\frac{dV}{dx}$ through polarization, not by changing K.

That Maxwell's criterion of the equality of the specific inductive capacity to the square of the index of refraction is so far from being fulfilled in the case of water and alcohol is not a serious objection to the notion that electrolytes possess a real specific inductive capacity. For comparatively few substances is $K = n^2$ within the limits of experimental error. Glass among solid, and castor oil and ether among liquid dielectrics are notable exceptions. These are usually explained by supposing that the electrical displacements in these dielectrics are much greater in a second or even a millionth of a second than they would be in periods of 10^{-15} sec., a thousand million times shorter, such as the period of light. J. J. Thomson[3] has recently shown that for periods of 4×10^{-8} sec. the value of K for glass is very much nearer to n^2 than for longer periods, and there is good reason for believing that K for periods equal to those of light waves would equal n^2. The electrical behavior of glass has been compared with the mechanical behavior of pitch, which is elastic to forces acting through short periods such as those of sound, but viscous to forces of long periods. If we accept this very reasonable explanation for glass we at once extend it to the large class of liquids of various degrees of insulating power called dielectrics, and for which K is greater than n^2; and also to that group of alcohols and their derivatives which Tereschin[4] has investigated and for which the values of K vary from 2 to 32. It is but another step to water with a value of K in the neighborhood of 75. One can easily imagine that for electrical stresses of a period 10^{-15} sec. K can equal n^2, that is be less than 2 and possess a temperature coefficient equal to that of n^2.

That a thing is conceivable and that it is demonstrated are not equivalent. Nevertheless, the behavior of water, alcohol and other conducting liquids as cited in the foregoing pages, and as given by other observers, seems to me to afford very strong reasons for attributing to these electrolytes a *genuine specific inductive capacity*.

This investigation was carried on under the general direction of Professor A. L. Kimball of the Johns Hopkins University. The experiments were made at the Physical Laboratory of the University of Wisconsin, and I take pleasure in acknowledging my obligation to Professor J. E. Davies, who generously placed at my disposal the utmost resources of his laboratory, and who furnished me with the beautiful rotating commutator, which was constructed from my design in the University machine shops.

JOHNS HOPKINS UNIVERSITY,
Baltimore, December 20, 1890.

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[1] *Proc. Roy. Soc.*, Vol. 46 (1889), p. 357, and *Phil. Trans.*, 1889.

[1] *Electricity and Magnetism*, Vol. I, p. 53.

[2] It is scarcely necessary to point out that the habit of reckoning the specific inductive capacity of metals as infinite when calculating the "reduced thickness" of the stratum between the plates of a condenser does not at all imply that if metals have a specific inductive capacity it must be infinite, or even large. Because of their conductivity there is an instantaneous distribution of electricity such that there is no fall of potential in passing through the plate of metal, and this is what would happen if the metal had an infinite specific inductive capacity and zero conductivity.

[3] *Proc. Roy. Soc.*, Vol. 46.

[4] *Wied. Ann.* Bd. xxxvi, S. 792 (1889).

Determinants Involving Powers of Circles. By WM. WOOLSEY JOHNSON.

(Abstract of a paper read before the *University Mathematical Society*, December 11, 1890.)

Denoting the rectangular coördinates and radius of a plane circle a by x_1, y_1, r_1, &c., and the determinant

$$\begin{vmatrix} x_1^2+y_1^2-r_1^2 & x_1 & y_1 & 1 \\ x_2^2+y_2^2-r_2^2 & x_2 & y_2 & 1 \\ x_3^2+y_3^2-r_3^2 & x_3 & y_3 & 1 \\ x_4^2+y_4^2-r_4^2 & x_4 & y_4 & 1 \end{vmatrix}$$

relating to four circles a, b, c, d, by $\Delta\ (a, b, c, d)$, we have for two groups of four circles each

$$\begin{vmatrix} aA & aB & aC & aD \\ bA & bB & bC & bD \\ cA & cB & cC & cD \\ dA & dB & dC & dD \end{vmatrix} = -4\,\Delta\,(a, b, c, d)\,\Delta\,(A, B, C, D).$$

in which the element aA is the "power" of the circles a and A, etc. [The power of two circles is the square of the distance between their centres diminished by the sum of the squares of the radii, and vanishes when the circles cut orthogonally]. It was thence shown that the value of $\Delta\ (a, b, c, d)$ is independent of the position of the origin and direction of the axes. The constant value of this quantity is the power of one of the four circles, say a, relatively to the circle orthogonal to the other three b, c, d, multiplied by twice the area of the triangle whose vertices are the centres of these three circles; this is also the constant value of

$$\alpha Oa + \beta Ob + \gamma Oc + \delta Od,$$

O being any point or circle, and $\alpha, \beta, \gamma, \delta$ being the double areas of the triangles formed by the centres of bcd, cda, &c., properly taken with respect to sign. $\Delta\ (a, b, c, d)$ vanishes for a group of four circles having a common orthotomic circle, and the power determinant for two groups of four circles vanishes if either group fulfils this condition.

For two groups of three circles each, it was shown that the power determinant is sixteen times the product of the areas of the triangles formed by the centres of the circles of each group multiplied by the relative power of the circles which are orthotomic to the two groups. In particular, the determinant of squared distances vanishes for two groups of three points each, if the circles passing through them cut at right angles.

The results are readily extended to groups of five and of four spheres, and, in particular, the determinant of squared distances vanishes for two groups of four points each if the spheres which pass through them cut at right angles, and also for two groups of three points situated, one group upon a sphere, and the other upon a circle orthotomic to it.

A Problem in Vector Analysis. By C. H. CHAPMAN.

(Abstract of a paper read before the *University Mathematical Society*, January 15, 1891.)

The matrix $\begin{pmatrix} x00 \\ 0y0 \\ 00z \end{pmatrix}$ which is referred to its axes, assumed to be rectangular, may represent a vector. The sum of two such matrices will then represent the sum of the corresponding vectors, and the product of the vectors was so defined as to be representable by the product of the matrices. Such matrices are commutative in multiplication, and their division is unambiguous.

The circular substitution $(x, y, z;\ y, z, x,)$ performed on the constituents of such a matrix rotates the corresponding vector about the vector $\begin{pmatrix} 100 \\ 010 \\ 001 \end{pmatrix}$ conically and in a negative direction through an angle of 120°. Denoting this substitution by "cy" and the matrix or vector by ρ, we have

$$cy\,(cy\rho) = cy^2\rho \text{ and } cy^3\rho = \rho.$$

Any rotation of this kind may therefore be denoted by $cy^{\frac{3\theta}{2\pi}}\rho$. It was proposed to find a vector μ such that $\mu\rho = cy^{\frac{3\theta}{2\pi}}\rho$.

The equations for μ are:

$$S.\mu\rho = S\rho;\ S.\mu^2\rho^2 = S.\rho^2$$

and $$3 \cdot S\mu\rho^2 = (3S.\rho^2 - S.^2\rho)\cos\theta + S.^2\rho.$$

To avoid the necessity for solving a quadratic, a vector ν was introduced which rotates $\mu\rho$ through an angle; we thus obtain three more equations:

$$S.\nu\mu\rho = S.\rho;\ S.\nu^2\mu^2\rho^2 = S.\rho^2$$
$$3S.\nu\mu^2\rho^2 = (3S.\rho^2 - S.^2\rho)\cos\phi + S.^2\rho;$$

two of which are linear in ν. A third equation linear in ν is obtained by considering that $\nu\mu$ rotates ρ through the angle $\theta + \phi$. We thus obtain

$$3S.\nu\mu\rho^2 = (3S.\rho^2 - S.^2\rho)\cos(\theta + \phi) + S.^2\rho.$$

The solution of these equations gives after assuming for μ the value $\frac{cy\rho}{\rho}$ and consequently for θ the value $\frac{2\pi}{3}$:

$$3\nu cy\rho = 2V(\upsilon, cy\rho)\cos\left(\frac{2\pi}{3} + \phi\right) + 2V(\rho, \upsilon)\cos\phi + \upsilon S.\rho,$$

where υ denotes the matrix $\begin{pmatrix} 100 \\ 010 \\ 001 \end{pmatrix}$ and the corresponding vector. The remaining notations were explained in the paper. From this equation we find:

$$3\mu\rho = 2V(\upsilon, \rho)\cos\left(\frac{2\pi}{3} + \phi\right) + 2V(cy^2\rho, \upsilon)\cos\phi + \upsilon S.\rho.$$

The corresponding equation for a rotation around any axis whatever, υ', is:

$$3\mu\rho = \upsilon' S\,\upsilon'\rho + 2V(\upsilon', \rho)\cos\left(\frac{2\pi}{3} + \phi\right) + 2V(cy'^2\rho, \upsilon')\cos\phi.$$

For an infinitesimal rotation this becomes:

$$3\mu\rho = 3\rho + \sqrt{3}\,d\phi\,V(\rho, \upsilon').$$

It was further remarked that the vanishing of the determinant $\begin{vmatrix} cy\alpha & cy\alpha & cy^2\alpha \\ cy\beta & cy\beta & cy^2\beta \\ cy\gamma & cy\gamma & cy^2\gamma \end{vmatrix}$ leads, when α, β, and γ lie in the same plane, to the equation

$$\alpha' \sin A + \beta' \sin B + \gamma' \sin C = 0,$$

where α', β', γ', are unit vectors parallel to α, β, γ, respectively. The interpretation of this equation gives the law of sines for a plane triangle.

The Historical Development of the Canadian Constitution. By WILLIAM HOUSTON.

(Abstract of a course of four lectures delivered by William Houston, M. A., Librarian to the Legislature of the Province of Ontario, to the graduate students in History and Political Science, November 20–22, 1890.)

The first lecture was devoted to a contrast between the conditions of colonial life and development in French Canada, prior to the treaty of Paris, 1763, and the corresponding conditions in the English colonies of the same period in what afterwards became the United States. It was pointed out that while the English colonies were "plantations" in the real sense of that term as it was then used, the French colony of Canada was the result of the operation of other motives than a desire to settle the country with an industrial population. The abject political servitude of the French colonists was brought into sharp contrast with the exceptionally free political life of the English settlers with their almost entirely uncontrolled management of their own local affairs. A similar contrast was drawn between the State churchism of French Canada, on the one hand, and the democratic ecclesiastical systems of the English colonies on the other; and a a third contrast, equally pointed, was shown to exist as between the rigid military system of Canada, and the spirited, if at times ill-regulated, military enterprise of New England and Virginia. The contrast was extended to include the results of a century and a half of each kind of occupation. In 1760 Canada had a French population of perhaps 70,000, scattered in detached settlements along the valley of the St. Lawrence and as far west as the Mississippi; the English colonies had a population perhaps of 2,000,000 in a comparatively small area and enjoying a high degree of industrial prosperity.

The second lecture was an account of the Government of Canada between 1763 and 1774. In the latter year the conquered country ceased to be a Crown colony and was for the first time provided with a constitution, which is to be found in the "Quebec Act." Amongst the provisions of that celebrated document are (1) the extension of the boundaries of the original Quebec southward to the Ohio and westward to the Mississippi; (2) the creation of a legislature made up entirely of members appointed by the Crown; (3) the formal recognition of the old French feudal system; (4) the enactment of Canadian law (the coutume de Paris) as the rule of decision in all controversies relating to property and civil rights; (5) the establishment of the Roman Catholic Church in the legal right to such privileges as it had enjoyed under the French *régime*; and (6) the attempted establishment of a Protestant Church as an offset to the Roman Catholic establishment. These important concessions to the French people and clergy were accounted for by the desire of Lord North and George III to prevent Canada from being drawn into the stream of the American Revolution, and the failure of the expedition of Montgomery and Arnold shows that the scheme was from that point of view successful.

In the third lecture an outline was given of the constitution conferred on Upper and Lower Canada, into which Quebec was divided by the constitutional act of 1791. The occasion of that act was the influx of U. E. Loyalist English-speaking settlers from the neighboring States after the treaty of Paris, 1783. English law was at once introduced into Upper Canada as the rule of decision, and trial by jury was brought in along with it, while Canadian law was retained in Lower Canada, and is still the legal system of the present Province of Quebec. In the same lecture a sketch was given of the provisions of the union act of 1840, and of the causes which led to its passage. Want of control by Canadians over the administration of their own affairs was partly the cause of the rebellion of 1837–38, and the social conflict between the French and English races assisted in bringing the trouble to a head. Lord Durham's masterly description of the state of Canada, in the report which he prepared as special commissioner, was outlined and his recommendations were mentioned as the basis of the union act, under the operation of which responsible government was introduced, municipal institutions were established, Protestant state churchism was abolished in Upper Canada, and provision was made for the extinction of "feudal dues and rights" in Lower Canada.

The causes which led to the passage of the British North America Act, 1867, were given in the fourth lecture. The chief cause assigned was the existence of the French and English races, with well marked and irreducible differences of religious, political, and social life. The area of Canada was enlarged (1) by taking in the old Acadia (Nova Scotia and New Brunswick); (2) by the purchase of the Hudson Bay territory; and (3) by the annexation of British Columbia. The federal form of the constitution of Canada was modelled on that of the United States, but the system of responsible administrative government was drawn from Great Britain since 1840. No attempt was made to forecast the future of this twenty-three-year-old confederation, but attention was called to the fact that partly because it is similar to and yet different from the Constitution of the United States, and partly because the Canadians are a contiguous and kindred people, the Canadian constitution must always be a suitable subject of investigation for students of political science.

ARCHÆOLOGICAL INSTITUTE OF AMERICA.

Baltimore Society.

January Meeting (75 persons present. President Gilman in the chair; J. Le Roy White, Secretary).

Extracts were read to the Association from letters recently received from correspondents at a distance, viz:—

(*a*). From Dr. Cyrus Adler, an Associate of this University, dated Constantinople, December 25 and 27. He stated that the two museums of archæology were closed to visitors because the objects are in process of removal from one place to another. The new museum building is beautiful, and there are enough Ancient Greek, Mediæval, and Hittite objects lying in the gardens about the museums to fill another building. He saw four of the new Sidonian sarcophagi, and was as much impressed by their beauty as other observers have been. (See the letters of Dr. J. P. Peters in recent numbers of *The Nation.*)

(*b*). From Henry Gillman, United States Consul at Jerusalem, saying that "when excavating for the sewer and paving of the street running south of the Austrian Hospice and past the Ecce Homo Convent and Church, an ancient Roman pavement, several feet below the surface, was discovered, similar to the massive ancient pavement uncovered two years ago in the adjoining streets. . . . . This last discovered pavement runs from the Roman pavement of the Damascus Road Street, past the Turkish Barracks and Ecce Homo Convent (as already mentioned) to the Tower of Antonia. . . . . This is another justification of the assumptions of the sagacious Robinson.—It is important to note that the pavement recently found opposite the Convent is exactly on the level of the Roman pavement beneath that building, a further confirmation of its being indeed the Gabbatha (John xix., 13)."

(*c*). From Dr. Manatt, U. S. Consul at Athens, in which he says (Oct. 24, 1890), "you, of course, have heard of the splendid things uncovered at Rhamnous, near Marathon, and now in the National Museum, though it is not yet a month since they saw the light. In fact they were found on the 27th, and delivered to the Museum on the 29th, ultimo. The Themis statue (pedestal with inscription and all) is the most exquisite thing I ever saw—I have not yet seen the Hermes—and almost absolutely perfect in its condition. Only a little chip off the chin and the right fore-arm missing. It is "the pearl of the Museum," above life-size, but as delicate as a cameo, and, what is most surprising, it bears the signature of an artist hitherto unknown and a demesman of the provincial town for whose temple it was made: *Χαιρέστρατος Χαιρεδήμου Ῥαμνούσιος ἐποίησε.* I have no doubt the critics will have to add Chaerestratos, the Rhamnusian, to the roll of foremost names in the history of Art. And there is one more inducement for art-lovers like yourselves to revisit Greece."

(*d*). From Hon. Ernest H. Crosby, giving some particulars concerning the recent death of Hon. Eugene Schuyler, late U. S. Consul in Cairo.

An announcement was made that the Trustees of the University had voted to continue their subscription to the American School in Athens, which has been sustained for the last ten years largely at the expense of certain American institutions of learning.

Professor Allan Marquand of Princeton then read a paper on *The Rise of Ionic Architecture*, of which the following brief abstract has been prepared:—

The object of this paper was to show that the forms of Ionic Architecture were not a free and independent creation of the Greek imagination, but are found from earliest times in Egypt. It was first shown that the general dispositions of the Greek temple, the temenos, sacred springs, sacred trees, altar in front of the temple and the surrounding peribolos are all found in Egypt, and that the ground plan may be explained as a development of the Egyptian temple plan. The special characteristics of the Doric order, the diminution, entasis and channelling of the columns, the annuli and echinus of the capital and the triglyphal prize were traced to Egyptian prototypes. After showing various types of Ionic capitals and proto-Ionic friezes from Cyprus, Cappadocia, Assyria and Babylonia, a series of Egyptian examples were exhibited, proving that all the features of the Ionic capital, its kymation, volutes, angle-palmettes and abacus together with its peculiar forms of 'heart leaf' and 'egg and dart' ornament date from the V Dynasty of the ancient Egyptian Empire. The Corinthian capital was then shown to be a derivative from well known Egyptian forms.

Papers were also read by Mr. Talcott Williams of Philadelphia, on *Historical Survivals in Morocco*, and on *A Helmet from Lake Van.* No abstracts of these papers have been received.

RECENT APPOINTMENTS.

Felix Lengfeld (Fellow, 1887–88, Ph. D., 1888)—Professor of Chemistry and Assaying in the South Dakota School of Mines.

C. W. Emil Miller (A. B., 1882, Fellow, 1883–85, Ph. D., 1886)—Professor of Languages, Walther College, St. Louis, Mo.

Augustus T. Murray (Fellow, 1887–88, Ph. D., 1890)—Professor of Greek, Colorado College.

Charles L. Smith (Fellow, 1887–88, Ph. D., 1889, Instructor, 1889–91)—Professor of History, William Jewell College, Mo.

Edward L. Stevenson (Graduate Student, 1887–88)—Instructor in History, Rutgers College.

Amos G. Warner (Fellow, 1886–87, Ph. D., 1888)—General Superintendent of Charities in the District of Columbia, as provided by the recent Congressional appropriation for the District.

William K. Williams (Ph. D., 1889)—Superintendent of Classification and Distribution in the Newberry Library, Chicago.

Albert Shaw (Ph. D., 1884), has become the American editor of the *Review of Reviews.*

EXEMPTION OF EDUCATIONAL PROPERTY FROM TAXATION.

[The following statements are reprinted from Professor F. W Blackmar's History of Federal and State Aid to Higher Education in the United States, recently issued by the U. S. Bureau of Education.]

" *Constitutional provisions for the exemption of educational property from taxation.*[1]

(1) Public school-houses are exempted in the following five States: California, Colorado, Ohio,[2] Louisiana, and South Carolina.

(2) School buildings and apparatus are exempted in the following five States: Arkansas, Georgia,[2] Louisiana, South Carolina, and Texas.

(3) Library and grounds used for school purposes are exempted in the following five States: Arkansas, Colorado, Georgia,[2] Louisiana, and South Carolina.

(4) Academies are exempted from taxation in Georgia,[2] Minnesota, and South Carolina.

(5) Colleges, universities, and seminaries of learning are exempted in Georgia,[2] Minnesota, Louisiana, and South Carolina.

(6) Any public property held for educational purposes is exempted in the following thirteen States: Alabama,[2] Florida,[2] Illinois,[2] Indiana,[2] Kansas, Nebraska,[2] Nevada,[2] North Carolina,[2] Oregon,[2] South Carolina,[2] Tennessee,[2] Virginia,[2] and West Virginia.

(7) Property used for scientific purposes is exempted from taxation in the following States: Florida,[2] Indiana,[2] Kansas,[2] Nevada,[2] North Carolina,[2] Oregon,[2] South Carolina, and West Virginia.

(8) Property used for literary purposes is exempted in all of the States named in the last (7th) paragraph."

" *Provisions by statute laws for the exemption of educational property from taxation.*

(1) Productive property, or such as is held as an investment for the support of non-State schools, is exempt from taxation in the following States: Connecticut, Indiana, Kentucky, Louisiana, Maine, Minnesota, Mississippi, Nebraska, North Carolina, Oregon, Rhode Island, Tennessee, Vermont Virginia.

(2) Unproductive property, or such as is invested in buildings, grounds, libraries, apparatus, etc., used and occupied exclusively for educational purposes by non-State schools, is exempt from taxation in the following States: Alabama, Arkansas, Colorado, Dakota, Delaware, Florida, Georgia, Illinois, Iowa, Kansas, Maryland, Massachusetts, Michigan, Missouri, Montana, Nevada, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, South Carolina, Texas, Washington, West Virginia, Wisconsin.

(3) All school property not belonging to State institutions is taxed in one State: California."

"The [foregoing] facts relative to the taxation of school property have been collected with considerable difficulty and with great care.

"The writer has examined the constitutional and statute laws of the several States, as well as many of the State reports, and has written to each State Superintendent of Public Instruction (or Secretary or Commissioner of Education), who, in reply, has given the actual practice in his own State. In the majority of cases the State Constitutions grant to the Legislatures power to enact laws for the exemption of school property from taxation, but in a few instances the Constitutions are imperative, leaving the Legislatures no choice in the matter.

"The Legislatures have frequently failed to exercise to the full extent the powers granted them and have not followed constitutional provisions with legislative enactment. In the past, legislation has been highly favorable to non-State schools, and the present general policy, so far as it may be stated, is to exempt from taxation all property used exclusively for school purposes and not held for gain, and to tax all property owned by private or sectarian institutions of learning and held as productive investment, that is, to tax productive and to exempt unproductive non-State school property.

"There are some notable exceptions to this general rule, and the variety of statute laws and their respective interpretation render the practice in respect to the extent of exemption widely diverse in the several States. For instance, Rhode Island and Providence Plantations granted, in the charter of Brown University, 'That the college estate, the estates, persons, and families of the president and professors, for the time being, lying and being within the colony, with the persons of the tutors and students during their residence at the college, shall be freed and exempted from all taxes, serving on juries, and menial services. And the persons aforesaid shall be exempted from bearing arms, impresses, and military services, except in case of an invasion.' In 1863, it was enacted 'That the estates, persons, and families of the president and professors, for the time being, and of their successors in office, shall not hereafter be freed and exempted from taxes for more than the amount of ten thousand dollars for each of such officers, his estate, person, and family included.' But the law still exempts all property of every description belonging to the university. The general statute of Rhode Island pertaining to this subject exempts buildings and grounds occupied for educational purposes, the amount of ground so exempted being limited to one acre.

"It may be stated, however, that the property of the East Greenwich Academy is not taxed; and that the large property of the Friends' School at Providence was free from taxation prior to 1878, but since that time it has been taxed about three thousand dollars yearly.

"In Vermont 'real and personal estate granted, sequestered, or used for public, pious, or charitable uses' are exempt from taxation.

"The lands set apart for the maintenance of the university of Vermont are leased for the support of the university. They are now and always have been exempt from taxation.

"Up to the year 1888 all property of educational institutions in Maine was exempt from taxation, but the Legislature has recently enacted a law which provides that real property, when held as an investment, is taxable in the municipality where it is situated; but the State rebates to the institution whose property is so taxed the amount of the tax, not to exceed one thousand five hundred dollars to any one institution.

"A policy similar to that pursued in Maine obtains in Connecticut under the present statute law. The three prominent institutions of learning, Yale and Wesleyan Universities and Trinity College, have productive property exempted, extending in each case to an amount sufficient to yield an income of six thousand dollars per annum.

"In the State of Tennessee the law exempts all property of every description managed by a board of trustees and used for school purposes.

"This law has been recently tested in the Supreme Court, in which it was found that a tract of land partly occupied for school purposes, but used mostly as a productive investment for the support of the institution, is exempted from taxation.

"Kentucky exempts 'real estate and investments' devoted to the support of universities, colleges, and seminaries of learning.

"The Constitution of Kansas expressly declares that property used for educational purposes shall be exempted from taxation, but the exemption applies to property only in actual use for educational purposes, and hence, as the interpretation shows, unimproved real estate held with a view to future educational use is not freed from taxation.

"Illinois reverses the policy and exempts land owned by an institution not in use, but held with a view to future use.

"Again, we find that professors' houses are not taxed in New Jersey, and that the same policy prevails in Iowa when the said houses are the property of an acknowledged educational institution.

"In Louisiana the law is very explicit in exempting school property and its income from taxation.

"Virginia exempts real estate and personal property from taxation, when they or their proceeds are used exclusively for the purpose of education.

"Sufficient examples have been given to illustrate the variety and scope of the policies in the different States respecting the exemption of unproductive school property from taxation."

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[1] Stimson—American Statute Law, sec. 332. (1886.)

[2] In these States the Constitution provides, in each case mentioned, that the property referred to "*may*" be exempted from taxation; in other States the declaration is imperative.

RECENT RECOGNITION OF SIDNEY LANIER.

On October 17, 1890, a bronze bust of Sidney Lanier (a replica of one modelled by E. Keyser, belonging to this University) was unveiled in Macon, Ga., the city of his birth. Many personal friends of the poet, and admirers of his genius participated in the ceremonies, or sent cordial and sympathetic letters; and the following poem by a son of the late poet, Paul Hayne, was read:

Unveil the noble brow, the deep-souled eyes,
Wherein melodious unities
Of Music and of Poetry were born.
For undeterred by Care's half sluggish thorn,
Barbed oft with suffering, he bravely brought
To Song's full bloom his lyric buds of thought.
Here love and homage shall, alike, proclaim
The undying whiteness of our poet's fame;
Wed to the marble, yet exempt from cold,
As winter clouds blessed by the sun's warm gold.

And now I hear,
Far off, yet clear,
Two voices that are one,—
For, drawing close to Music's feet,
'Tis thus her Lyric sister sweet,
Sings of their cherished son:

Strong-winged and free each mood of me
Thrilled through his heart and brain;
His soul was lit by lights that flit
Across the waving grain!
The marshes drear, he made a prayer
With words whose wondrous flight
Bore thoughts that reach through rhythmic speech
To sunlands out of sight!

He let no seed, from doubt's dark weed,
Fall in the holy shrine
Where Song was bred by Music led,
To beckoning heights divine!
And seldom mute, his silver flute
Invoked, with matchless art,
Each wave of sound, by Silence bound,
Within her vestal heart!

Death's Arctic fear,—"a cordial rare"
To his enraptured dream,—
Came from the blue, his spirit knew
Of Love and Faith supreme!
His "Sunrise" song, with rapture strong,
Rose like a lark in light;
Who feels the sway of sovereign Day
Reign o'er the mists of Night!

He loved the flow of winds that blow
To "odor-currents" set;
The gem-like hue of fleeting dew,
Frail rose and violet;
The soul in trees, whose litanies
His reverent spirit heard,—
The corn-blades rife with vernal life,
The rune of bee or bird!

Strong-winged and free, each mood of me
Thrilled through his heart and brain;
His soul was lit by lights that flit
Across the waving grain!
The marshes drear, he made a prayer
With words whose wondrous flight
Bore thoughts that reach through rhythmic speech
To sunlands out of sight!

William H. Hayne.

The opinion expressed by more than one at this meeting, that the genius of Lanier was obtaining ever-widening recognition, has been confirmed in an interesting way by the appearance of the following criticism, which is of peculiar value as the judgment of a critic entirely free from either patriotic or personal bias.

A Review of Lanier's Poetry.

(From *The Spectator*, London, December 6, 1890.)

The best poetry of the United States has always seemed to us more remarkable for refinement and fancy than for either passion or power. We are not, of course, speaking of the humorous poetry, which is a class by itself, and is in every respect sufficiently unique and original, but of the serious poetry, the poetry which deals directly with the deepest life. No one can say that *Hiawatha* is a poem of high passion, or that Mr. Lowell's finest poems, outside the region of humor, are poems of high passion. Sidney Lanier may claim to have been such a poet, though he was only thirty-nine when he died, and had to struggle with poverty all the years of his life, so that even in the twenty or so years of his mature powers, a great deal of effort had to be devoted to the hard work of keeping the wolf from the door. He was the first, too, of notable Southern poets. He was born at Macon in Georgia, and fought on the southern side in the Civil War of 1861-65. He had received a scrambling sort of college education, but his opportunities of culture were so meagre, that we can hardly understand where he got that delicacy of culture and that real love of learning which distinguished him almost as much as his vigorous imagination and depth of passion. There was nothing of the Massachusetts chill and fastidiousness about him, and occasionally, no doubt, his prose sounds to English ears a little stilted, though chiefly in the fashion of Elizabeth Barrett Browning, in other words, because he insists too much on the poet's right to be a little unnatural, or even to other ears affected, so long as his novelties of expression sound true to himself, and not because he is anxious to "whip creation," as the Yankees say, by straining to surpass anything that has been said before. For example, the following, from his description of "the true democrat," sounds to our ears decidedly stilted, and it would have repelled us, even as Walt Whitman repels us, if we had found very much of it, or any strain like it in his poetry:—

> "My democrat, the democrat whom I contemplate with pleasure, the democrat who is to write or to read the poetry of the future, may have a mere thread for his biceps, yet he shall be strong enough to handle hell; he shall play ball with the earth; and albeit his stature may be no more than a boy's, he shall still be taller than the great redwoods of California; his height shall be the height of great resolution, and love, and faith, and beauty, and knowledge, and subtle meditation; his head shall be forever among the stars.'

But there was too much of the true critic in Lanier to admit of much tall-talk. He did not habitually aim at playing "ball with the earth," or "handling hell." He was a modest as well as an imaginative poet, and could see the absurd side of the stilted imagination of Walt Whitman, as well as any cultivated Englishman. What could he have said of Whitman better than this?—

> "Whitman is poetry's butcher. Huge raw collops slashed from the rump of poetry, and never mind gristle—is what Whitman feeds our souls with." "As near as I can make it out, Whitman's argument seems to be, that, because a prairie is wide, therefore debauchery is admirable, and because the Mississippi is long, therefore every American is God."

He is not quite so happy in his criticism on Swinburne: "He invited me to eat, the service was silver and gold, but no food therein save pepper and salt;" for no one can say of *Atalanta in Calydon*, or even of *Bothwell*, that there is nothing in it but condiment. And, on the other hand, the service is by no means always of silver and gold, for the Swinburne verbiage is often so oppressive that the alloy presses itself on the attention a great deal more than the precious metal. But here is an exquisite criticism on William Morris: "He caught a crystal cupful of the yellow light of sunset, and persuading himself to dream it wine, drank it with a sort of smile." But Lanier's critical faculty, which was large, was not so considerable as his poetical faculty. Take the following, from a poem to his Wife, to show how genuine and individual was the imagination that entered into his expression of feeling:—

"O Love, O Wife, thine eyes are they,
—My springs from out whose shining gray
Issue the sweet celestial streams
That feed my life's bright Lake of Dreams.

Oval and large and passion-pure
And gray and wise and honor-sure;
Soft as a dying violet-breath
Yet calmly unafraid of death;

Thronged, like two dove-cotes of gray doves,
With wife's and mother's and poor-folk's loves,
And home-loves and high glory-loves
And science-loves and story-loves,

And loves for all that God and man
In art and nature make or plan,
And lady-loves for spidery lace
And broideries and supple grace

And diamonds and the whole sweet round
Of littles that large life compound,
And loves for God and God's bare truth,
And loves for Magdalen and Ruth,

Dear eyes, dear eyes and rare complete—
Being heavenly sweet and earthly sweet,
—I marvel that God made you mine,
For when He frowns, 'tis then ye shine!"

No doubt there is here and there in the poem a hint of the desire to say in a striking way what would best have been said in a subdued way; and again we cannot say that we like at all the—

"high glory-loves
And science-loves and story-loves."

But nothing can be more perfect than—

"the whole sweet round
Of littles that large life compound;"

and the touch of wonder in the last two lines of the poem is as simple and exquisite as any touch of tenderness in our literature.

Take again, as a specimen of that fancy which is really more than fancy,—true imagination disguising itself as fancy,—the very fine sonnet on "The Harlequin of Dreams:"—

"Swift, through some trap mine eyes have never found,
Dim-panelled in the painted scene of Sleep,
Thou, giant Harlequin of Dreams, dost leap
Upon my spirit's stage. Then Sight and Sound,
Then Space and Time, then Language, Mete and Bound,
And all familiar Forms that firmly keep
Man's reason in the road, change faces, peep
Betwixt the legs and mock the daily round.
Yet thou canst more than mock: sometimes my tears
At midnight break through bounden lids—a sign
Thou hast a heart: and oft thy little leaven
Of dream-taught wisdom works me bettered years.
In one night, witch, saint, trickster, fool divine,
I think thou'rt Jester at the Court of Heaven!"

There seems to us no easily assignable limit to the genius of the man who wrote that. The first part of the sonnet is as powerful as anything we know of the kind; but the conclusion of it takes us into a higher region of imagination altogether, and paints the "harlequin of dreams" as the minister of God. Here is a younger and much less perfect poem, which may be said to have something in it of the straining ambition of youth, and yet, for a young man's effort to describe his terror of life, in the "Sturm und Drang" period of his growth, how powerful it is!—

"Thou Ship of Earth, with Death, and Birth, and Life, and Sex aboard,
And fires of Desires burning hotly in the hold,
I fear thee, Oh! I fear thee, for I hear the tongue and sword
At battle on the deck, and the wild mutineers are bold!
The dewdrop morn may fall from off the petal of the sky,
But all the deck is wet with blood and stains the crystal red.
A pilot, God, a pilot! for the helm is left awry,
And the best sailors in the ship lie there among the dead!"

The poem which follows it, "How Love Looked for Hell," and, we may add, did *not* find it, may be set off against this. It is too long to quote, and we may add that its tendency is a little too much in the mood of the modern sentimentalism; yet it is a thoroughly original poem, quaint indeed, but quaint with a simplicity of its own, and not with that affected quaintness which Lanier now and then puts on. That we have in Lanier an original poet,—one more original, we think, than the United States has ever yet produced, more original than any poet whom England has produced during the last thirty years at least,—we feel no sort of doubt. Mr. William Hayes Ward, who has prefixed an interesting Memorial, speaks of the first poem in the volume, "Sunrise," as the finest it contains. Of that we are not sure, but it is certainly a very noble poem of its kind, a picture of sunrise over the salt-marshes near the sea, of remarkable brilliance and fascination. It is a little ambitious. It seems to stand on tip-toe here and there with its desire to express the inexpressible. Still, no one but a poet, and a poet of true genius, could, we think, have written this on the coming of dawn:—

"Oh, what if a sound should be made!
Oh, what if a bound should be laid
To this bow-and-string tension of beauty and silence a-spring,—
To the bend of beauty the bow, or the hold of silence the string!
I fear me, I fear me yon dome of diaphanous gleam
Will break as a bubble o'er-blown in a dream,—
Yon dome of too tenuous tissues of space and of night,
Over-weighted with stars, over-freighted with light,
Over-sated with beauty and silence, will seem
But a bubble that broke in a dream,
If a bound of degree to this grace be laid,
Or a sound or a motion made.

But no: it is made: list! somewhere,—mystery, where?
In the leaves? in the air?
In my heart? is a motion made:
'Tis a motion of dawn, like a flicker of shade on shade.
In the leaves 'tis palpable: low multitudinous stirring
Upwinds through the woods; the little ones, softly conferring,
Have settled my Lord 's to be looked for; so—they are still;
But the air and my heart and the earth are a-thrill,—
And look where the wild duck sails round the bend of the river,—
And look where a passionate shiver
Expectant is bending the blades
Of the marsh-grass in serial shimmers and shades,—
And invisible wings, fast fleeting, fast fleeting,
Are beating
The dark overhead as my heart beats,—and steady and free
Is the ebb-tide flowing from marsh to sea—
(Run home, little streams,
With your lapfulls of stars and dreams),—
And a sailor unseen is hoisting a-peak,
For list, down the inshore curve of the creek
How merrily flutters the sail,—
And lo, in the East! Will the East unveil?
The East, is unveiled, the East has confessed
A flush: 'tis dead; 'tis alive: 'tis dead, ere the West
Was aware of it: nay, 'tis abiding, 'tis unwithdrawn:
Have a care, sweet Heaven! 'Tis Dawn.

Now a dream of a flame through that dream of a flush is uprolled:
To the zenith ascending, a dome of undazzling gold
Is builded, in shape as a bee-hive, from out of the sea:
The hive is of gold undazzling, but oh, the Bee,
The star-fed Bee, the build-fire Bee,
Of dazzling gold is the great Sun-Bee
That shall flash from the hive-hole over the sea."

Let us add that Lanier has plenty of humor. Amongst what he called the "Dialect Poems," there are several brimfull of it,—as, for example, the first of the series, which he calls "A Florida Ghost."

Lanier died so early that he did not really show us more than the bud of his genius; but if he had lived ten years longer, he would, we believe, have ranked high among English poets, and probably above every American poet of the past. As it is, we think there is more of genius in this volume than in all Poe's poems, or all Longfellow's, or all Lowell's (the humorous poems excepted); and the poetry is, we think, of the kind that gains on us with familiarity, instead of losing ground.

(From *The Independent*, N. Y., December, 1890.)

. . . . Possibly the rarest fern in the United States is *Asplenium ebenoides*. It was first found as a solitary plant along the Schuylkill, near Philadelphia, forty years ago. About ten years ago a number were found by Miss Tutweiler, at Huntsville, Alabama. Recently Mr. S. L. Powell, of Johns Hopkins University, has found it in considerable abundance on Kulp's hill, a part of the famous battle-field of Gettysburg. It was growing with *Camptosorus rhizophyllus*, and *Polypodium vulgare*, the former its usual companion.

. . . . It appears from the studies of Mr. R. P. Bigelow on the habits of the Portuguese man-of-war, that this interesting jelly-fish feeds largely on small fish, which, swimming against its tentacles are caught and benumbed. The fish struggling to free themselves from contact with the poisonous tentacles, cause the latter to contract, and thus the prey is drawn up to the feeding-bells. If the fish does not struggle, the tentacles fail to contract. The feeding-bells spread themselves over the fish and digest it.

RECENT PUBLICATIONS.

The following list enumerates recent publications by those who have been or are now members of this University. It is issued for the information of their colleagues and friends and is not supposed to be complete. See previous lists, *University Circulars* 79, page 44, and 81, page 78. Papers in the *University Circulars*, and the *Hospital Bulletin* are not here noted.

Adams, H. B. [J. M. Vincent, W. B. Scaife and others.] Seminary Notes on Recent Historical Literature. (*Studies in History and Politics*, 1890.)

—— American Historical Literature, 1885–1889. (*Revue Historique*, 1890.)

—— Report of Proceedings at Sixth Annual Meeting of the American Historical Association. (*Annual Report of American Historical Association, by the Secretary of the Smithsonian Institution, Washington*, 1890.)

—— Account of the Seventh Annual Meeting of the American Historical Association. (*Independent, New York, January* 8, 1890.)

Ames, J. S. On the Relations between the Lines of various Spectra, with Special Reference to those of Cadmium and Zinc, and a Redetermination of their Wave-lengths. (16 *pp.*, 12*o.*)

—— On some Gaseous Spectra: Hydrogen, Nitrogen. (10 *pp.*, 12*o.*)

These papers were accepted as a Thesis for the degree of Doctor of Philosophy in the Johns Hopkins University, 1890.

Andrews, C. M. The Beginnings of Connecticut Towns. (*Annals of American Academy of Political and Social Science, Philadelphia, October*, 1890.)

Andrews, E. A. Notes on the Anatomy of Sipunculus Gouldii Pourtalès. (*Studies from the Biological Laboratory, Vol. IV, No.* 7, 42 *pp.*, 8*o.*, 3 *plates.*)

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—— Report on Journal Asiatique. (*American Journal of Philology, Vol. XI, No.* 2, *July*, 1890.)—Report on Rheinisches Museum. (*Ib., Vol. XI, No.* 3, *October*, 1890.)

—— Semitic and other Glosses to Kluge's "Etymologisches Wörterbuch der deutschen Sprachen." Review. (*Modern Language Notes, December*, 1890, *January*, 1891.)

Belden, H. M. Winged Words. A Sonnet. (*Belford's Magazine, April*, 1890.)

Bell, Louis. Theory of Compound Winding for Constant Potential. (*Electrical World, XVI*, 23.)

Billings, J. S. (*Editor.*) Description of the Johns Hopkins Hospital. (*Baltimore*, 1890, 116 *pp., large* 4*o, and* 56 *plates.*)

Blackmar, F. W. Spanish Colonization in the South-west. (79 *pp.*, 8*o.*)

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Blackshear, C. C. Dioxybenzoyl-Benzene-Sulphonic Acid and Fluoresceïn. (30 *pp.*, 8*o.*)

Thesis accepted for the degree of Doctor of Philosophy in the Johns Hopkins University, 1890.

M. Bloomfield. The Kāucika-Sūtra of the Atharva-Veda. (*lxiii* + 422 *pp.*, 8*o.*; *presented to the Eighth International Congress of Orientalists*, 1889; *published by the American Oriental Society, New Haven*, 1890.)

—— The Nirukta Kautsavaya. (*Proceedings, American Oriental Society, October*, 1890.)

—— The Negro Question. A series of papers, bi-weekly. (*Sun, Baltimore, March–May*, 1890.)

—— Contributions to the Interpretation of the Veda, Second Series. (*American Journal of Philology, Vol. XI, No.* 3, *October*, 1890.)

[I. On the jāyānya-charm, and the apacit-hymns of the A. V. II. On *taṭīdyā* in the A. V. III. On the so-called fire-ordeal hymn in the A. V. IV. Women as mourners in the A. V. V. On a vedic group of charms. VI. On the vedic words *paḍbhis* and *pâḍbîça*.]

Bolza, Oskar. On the Theory of Substitution-Groups, and its Applications to Algebraic Equations. (*American Journal of Mathematics, January*, 1891.)

Bond, A. K. The Lung Disorders of the Prevailing Influenza. (*Medical and Chirurgical Faculty of Maryland, Transactions*, 1890.)

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—— Style and Chronology in Corneille. (*American Journal of Philology, Vol. XI, No. 2, July*, 1890.)

—— Primer of French Literature. (*Heath, Boston*, 1890, 250 *pp.*, 16*o.*)

Watase, S. On Caryokinesis. (*Biological Lectures, Wood's Holl*, 1890.)

—— On the Morphology of the Compound Eyes of Arthropods. (48 *pp.*, 8*o, and* 7 *plates.*)

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Wightman, A. C. On the Ventricular Epithelium of the Frog's Brain. (16 *pp.*, 8*o, and* 1 *plate.*)

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Wilkes, Gilbert. Applications of Electricity. (*Annual, Office of Naval Intelligence, U. S. Navy Department.*)

Williams, G. H. Elements of Crystallography for Students of Chemistry, Physics, and Mineralogy. (*Holt, N. Y.*, 250 *pp.*, 12*o*, 1890.)

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—— Non-Feldspathic Intrusive Rocks of Maryland and the Course of their Alteration. (*American Geologist, July*, 1890.)

Willoughby, W. W. The Supreme Court of the United States: Its History and Influence in our Constitutional System. (*Baltimore, Johns Hopkins Press*, 124 *pp.*, 8*o.*, 1890.)

Wilson, E. B. Some Problems of Annelid Morphology. (*Biological Lectures, Wood's Holl*, 1890.)

Wilson, Woodrow. The English Constitution. (*Chautauquan, Nov.*, 1890.)

Wood, H. Unconventional Uses of Natural Imagery in the Poems of Walther von der Vogelweide. (*American Journal of Philology, Vol. XI, No.* 2, *July*, 1890.)

Wright, C. B. What the College has a Right to Expect in English from the High School (*The Academy, Syracuse, N. Y., December*, 1890.)

LECTURES TO COLLEGE TEACHERS AND THOSE WHO PROPOSE TO BECOME SUCH.

A course of lectures and conferences will be given during February and March to those members of this University who are engaged in teaching, or who expect to become teachers. They will be given in Hopkins Hall on Saturday mornings. At the close of each lecture there will be an opportunity for an informal conference between the lecturer and his hearers. The course is designed for graduate students only. Lectures have been promised by the following persons.

The Use and Abuse of Examinations.
  Professor Nicholas Murray Butler, of Columbia College.
Study of Pedagogics in the University.
  Hon. J. L. M. Curry, General Agent of Peabody Education Fund.
Books that may be serviceable to Teachers of Colleges and High Schools at the beginning of their Career.
  Hon. W. T. Harris, U. S. Commissioner of Education.
The Relations of College Professors to their Environment.
  President Gilman.
The Common Errors of Young Teachers.
  Professor Griffin.
Instruction in Science.
  Professors Martin and Remsen.
Instruction in Language and Literature.
  Professor Gildersleeve.
The Art of Vocal Expression; Public Reading.
  Professor D. C. Bell, of Washington.
Public Speaking.
  Professor Adams.

LECTURES TO STUDENTS IN HISTORY AND POLITICS.

Hon. Carroll D. Wright, U. S. Commissioner of Labor, will give eight lectures, in February, on *Studies in Social Science*, with particular reference to phases of the labor question.

James Schouler, Esq., author of the "History of the United States under the Constitution," will give, in February and March, ten lectures on *American Political History.*

Hon. John A. Kasson, LL. D., of Washington, formerly U. S. Minister to Austria and to Germany, will give, in April and May, ten lectures on the *History of Diplomacy.*

Professor Woodrow Wilson, of Princeton College, will give, in February, twenty-five lectures on *Administration and Public Law.*

Professor J. F. Jameson, of Brown University, will give, in May, ten lectures on the *Constitutional and Political History of the Southern States.*

Dr. Albert Shaw, of Minneapolis, will give, during the Spring, a course of ten lectures on *American Cities and their Present Problems.*

UNIVERSITY SCHOLARSHIPS.

At a meeting of the Board of University Studies, January 7, University Scholarships were awarded to the gentlemen named below:

M. A. Mikkelsen,	History.	W. R. Fraser, -	Greek.
W. A. Scott, - -	Economics and Jurisprudence.	S. G. Stacey, -	Latin.
		H. C. Jones, - -	Chemistry.
R. G. Harrison, -	Biology.	P. J. Dashiell, -	Chemistry.
G. O. Squier, - -	Physics.	J. M. Willard, -	Mathematics.
F. J. Mather, Jr.,	English.	B. M. Roszel, - -	Astronomy.
J. Blume, - - -	Romance Languages.	A. B. Faust, - -	German.
		F. P. King, - - -	Geology

Professor William M. Davis, of Harvard University, gave three lectures before the University as follows:

1. *Tornadoes, a Story of a long Inheritance.* Before the Traveller's Club, January 27. 2. *The Triassic Sandstone of the Connecticut Valley.* Before the Geological Class, January 28. 3. *The Physical Geography of New England.* Before the Scientific Association, January 28.

Dr. H. A. Todd will give in Hopkins Hall a series of weekly readings in the *Divina Commedia*, consisting of a translation into English of the original text, with requisite comments. These readings—which will be open, without cards, to those interested in the study of Dante—will begin on Tuesday, January 27, at 4 p. m., and be continued at the same hour on successive Tuesdays in February, March, and April.

The Johns Hopkins Hospital Bulletin for January, just issued, contains reports of cases in which Dr. Koch's lymph has been used in the Hospital.

The Johns Hopkins Press has in preparation a volume by Professor W. K. Brooks on American Oyster Culture with special reference to the past and future of the oyster industry in Maryland. It will embody, with Dr. Brooks' previous reports on this subject, the conclusions he has reached from his later studies.

President Gilman's lectures upon the Mediterranean have been continued through the month of January. The last lecture was given January 31.

At the suggestion of Hon. Wm. T. Harris, U. S. Commissioner of Education, Mr. Alexander Melville Bell, of Washington, the well known author, gave a lecture before the University on January 6th, in illustration of his system of "visible speech."

Mr. James E. Keeler (A. B. 1881) has been elected a Fellow of the Royal Astronomical Society, London. Several of Mr. Keeler's recent contributions to astronomical research are noted under "Recent Publications" in this Circular.

Mr. R. G. Moulton, of the University of Cambridge, England, gave an address on University Extension, in Hopkins Hall, December 19.

PERCY TURNBULL MEMORIAL LECTURESHIP.

THE NATURE AND ELEMENTS OF POETRY.

A lectureship to treat of Poetry has been instituted in this University by the generosity of Mr. and Mrs. Lawrence Turnbull, of Baltimore, who thus commemorate the name of their son Percy Graeme Turnbull, who died in 1887.

In accordance with the terms of the gift, a course of lectures may be expected annually from some one who has gained distinction as a writer of poetry or as a critical student of the poetic art.

The Trustees have the pleasure of announcing that the first course of lectures on this foundation will be given by one who is both a poet and a critic, Mr. Edmund C. Stedman, of New York. His subject will be "The Nature and Elements of Poetry."

The lectures will be given in Levering Hall at 5 *o'clock punctually.*

A certain number of seats will be reserved until five minutes before five o'clock for members of the University who signify their intention to follow the course, and who apply for cards of admission. The other seats will be open to the public, and cards of admission will not be required.

I.
Oracles, Old and New.
(Introductory and historical, with considerations on Poetry and Science.)
Wednesday, March 4.

II.
What is Poetry?
Thursday, March 5.

III.
Creative Poetry and the Poetry of Self-Expression.
Friday, March 6.

IV.
The same topic continued, with special regard to modern times.
Wednesday, March 11.

V.
Beauty.
Thursday, March 12.

VI.
Truth.
Friday, March 13.

VII.
Imagination—Passion.
Wednesday, March 18.

VIII.
The Faculty Divine.
(Inspiration—Insight—Genius—Faith.)
Thursday, March 19.

LECTURES ON ENGLISH LITERATURE.

IN LEVERING HALL, AT 5 P. M.

LECTURES ON MILTON'S POETIC ART.

Richard G. Moulton, Esq., (M. A., Cambridge, England), four lectures, in January:

I. Milton's Picture of Hell. A Study in Poetic Composition.
Tuesday, January 6.

II. The Council of Fiends. A Study of the Classical Impulse.
Wednesday, January 7.

III. The War in Heaven. A Study of Narrative Power.
Thursday, January 8.

IV. The Ninth Book. A Study in Plot.
Monday, January 12.

THE EARLY ENGLISH GAWAIN ROMANCES.

Professor George Lyman Kittredge, of Harvard University, six lectures, in January:

I. Introduction.
  1. The Early English Metrical Romances, in general.
  2. The Round Table Romances.
  3. The Gawain Romances.
Wednesday, January 28.

II. The Carl of Carlisle. The Turk and Gawain. The Aunters of Arthur.
Thursday, January 29.

III. Gawain and the Green Knight.
Friday, January 30.

IV. Iwain and Gawain.
Monday, February 2.

V. The Wedding of Sir Gawain. The Avowing of Arthur. Arthur and Cornwall.
Tuesday, February 3.

VI. Golagros and Gawain. The Gest. Gawain in Malory's Morte Darthur and in Tennyson.
Wednesday, February 4.

LECTURES ON ENGLISH LITERATURE OF THE PERIOD OF QUEEN ANNE.

Professor C. T. Winchester, M. A., of Wesleyan University, eight lectures, in February:

I. General Characteristics of the Period.
Monday, February 9.

II. Politics, Parties and Persons.
Tuesday, February 10.

III. Daniel Defoe.
Thursday, February 12.

IV. Richard Steele.
Friday, February 13.

V. Joseph Addison.
Monday, February 16.

VI. Jonathan Swift before 1714.
Tuesday, February 17.

VII. Jonathan Swift after 1714.
Thursday, February 19.

VIII. Alexander Pope.
Friday, February 20.

THE BIRNEY COLLECTION OF BOOKS ON SLAVERY.

On January 15, the University received from General William Birney, of Washington, D. C., a valuable collection of books and pamphlets, numbering over one thousand titles, representing the history of slavery. The nucleus of the collection was formed by General Birney's father, James G. Birney, candidate for the presidency in 1840 and again in 1844. This original collection was largely increased by later accessions, and it probably forms one of the most complete collections of its kind in this country. It is to this library that General Birney was almost wholly indebted for the original materials which he used in the preparation of his work on the life and times of his father. General Birney, on the 8th instant, wrote to Dr. Adams, asking what disposition he could make of his books and pamphlets for the use of historical students. In reply, it was suggested that they should be placed in some academic library where they could be utilized for the study of slavery as an institution. On the 13th instant, General Birney tendered his collection to the University, saying: "On reflection, I have decided to give my collection of books and pamphlets on slavery to the trustees of Johns Hopkins University for the use of students, and especially of the members of the Historical Seminary. I regret that it is not well arranged. Several years ago, I had all my pamphlets bound in fair, chronological order. My acquisitions since that time are neither bound or classified, except partly by subject. I had intended to classify and rebind, including all to the present time. The present state of my health will not permit me to do this. I must leave this work to the Johns Hopkins University. All I can do now is to box up the collection as it is and send it to the University. Some of the titles are rare. The file of Lundy's paper is more nearly complete, or rather less incomplete, than any other in existence. All known complete files were burned up in 1838 in the conflagration of Pennsylvania Hall. I hope my contribution will be but one of many similar ones."

The most valuable part of the collection is probably to be found in the fifty odd volumes of bound pamphlets, the dates of many of which run back into the preceding century.

Among these may be seen the minutes of the first general Abolition Convention in 1794 and many succeeding meetings down to 1827; memorials presented to Congress 1790–91; the speech of Rev. David Rice in the Kentucky Constitutional Convention, 1792, known as the "Kentucky Protest;" Torrey's "Portraiture of Domestic Slavery," 1817, and the abundant circulars and reports of the American Anti-Slavery Society, the Maryland Colonization Society and similar associations. In the literature of the later phases of the great controversy, the political and religious warfare during the period 1835–1865, the pamphlet collection is especially rich.

Of larger works in bound form there are about three hundred and fifty volumes, including, beside histories of slavery and biographies of anti-slavery leaders, numerous pro-slavery works, among which may be mentioned as an early instance that of Robert Walsh of Baltimore "An Appeal from the Judgments of Great Britain respecting the United States of America," published in 1819.

A file of Osborn's "Philanthropist" for the years 1817–18 represents one of the earliest efforts of the century to spread the doctrine of abolition by means of a newspaper. The paper lived but three years in all, but is interesting from the fact of its connection with Benjamin Lundy, who was for a time publisher and co-editor, and afterwards established "The Genius of Universal Emancipation," a much more vigorous sheet which was published chiefly in Baltimore and counted for a time William Lloyd Garrison as an editorial contributor. Three volumes of the monthly and six volumes of the weekly edition of Lundy's paper are here preserved. Another "Philanthropist," established and for two years edited by J. G. Birney, afterwards became the "National Era." Of the former there are five volumes.

The Birney Collection has been placed in the alcove of Southern History, the beginning of which was made some years ago by Dr. J. F. Jameson, now professor in Brown University. In the month of May, Professor Jameson will return to Baltimore to give a course of ten lectures upon the Constitutional and Political History of the Southern States. The time is coming when a purely scientific and objective treatment of Southern history and of the institution of slavery can be undertaken. Dr. H. Von Holst once said in a public lecture in Hopkins Hall, that there was nothing in American literature about slavery as an institution. He said there was a vast deal of writing for slavery and against slavery, but nothing about it. This defect is likely to be corrected by the scholarly contributions of the present generation to Southern economic and social history. Dr. Curry, general agent of the Peabody Education Fund and also one of the trustees of the Slater Fund, has recently paid a high compliment to the work of Dr. Jeffrey R. Brackett, of this city, who published in the Johns Hopkins University Studies his monographs on "The Negro in Maryland" and "The Progress of the Colored People in Maryland since the War." The success of these essays should be encouraging to other students of the institutional history of slavery.

J. M. V.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

December 17, 1890.—Ninety-seventh regular meeting. Dr. Brooks in the chair. Seventy-six members present.

Papers read:
- Amoebae in Human Pathology, by W. T. COUNCILMAN.
- A New Acid, by E. RENOUF.
- The Work of the British Association for the Advancement of Science, by J. S. AMES.

Philological Association.

December 19, 1890.—One hundred and sixth regular meeting. Professor Gildersleeve in the chair. Thirty-nine members present.

Papers read:
- On the Knowledge of Latin Literature and Language among Greek Prose Writers, by A. GUDEMAN.
- Critical Notes on the Anglo-Saxon Gospels, by J. W. BRIGHT.

January 16, 1891.—One hundred and seventh regular meeting. Professor Gildersleeve in the chair. Forty-nine members present.

Papers read:
- Goethe's Debt to Shakespeare in Faust, by H. WOOD.
- Linguistic Position of Osmanli-Turkish, by J. DYNELEY PRINCE.
- The Phonetics of French *noël* and *novel*, Provençal *nadal* and *no el*, by H. A. TODD.

Historical and Political Science Association.

December Meetings.—Dr. H. B. Adams in the chair.
- The Theory of the Village Community, by C. M. ANDREWS.
- Economic History of the Whiskey Rebellion, 1794, by R. J. FINLEY.
- American Influence on the French Revolution, by E. L. STEVENSON.
- A Frenchman's Impressions of Maryland in 1791, by B. C. STEINER.
- Travel and Study in Germany, by INAZO NITOBE.
- University Study and Training in England, by R. G. MOULTON.

January Meetings.
- The Appointment of a Receiver for Nashville, by L. S. MERRIAM.
- Mandeville's Sociology, by E. A. ROSS.
- Remarks on the Indian Question, by Pres. MERRILL E. GATES of Amherst College, Chairman of U. S. Board of Indian Commissioners.
- Maryland's Attitude in the Struggle for Canada, by J. W. BLACK.
- The Northwest as a Field for Economic and Historical Study: comments on a letter of Dr. Albert Shaw, by M. A. MIKKELSEN.
- Higher Education of the People, by H. B. ADAMS.
- General Booth Anticipated, by DAVID KINLEY.

Mathematical Society.

December 11.

Papers read:
- Determinants Involving Powers of Circles, by WM. WOOLSEY JOHNSON. (*Abstract on p.* 46.)
- The Hessian of $u^k v$, by H. P. MANNING.

January 15, 1891.

Papers read:
- A Problem in Vector Analysis, by C. H. CHAPMAN. (*Abstract on p.* 46.)
- On the Transformation of Equations, by JOHN F. SPRINGER.

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